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ABSTRACT

This curriculum guide provides technology learning activities designed to prepare students in grades 6-10 to work in the world of the future. The 8-day course provides exploratory, hands-on learning activities and information that can enhance the education of students of all types in an integrated curriculum that provides practical applications of academic skills. The guide contains both instructor and student sections. The instructor's section includes the following: background information; expected learner outcomes; suggested activities; suggested resources; instructional sequence; equipment, tools, and supplies worksheet; pretest and posttest with answers; and an evaluation summary. Contents of the student's section are as follows: an introduction; summary of activities; pretest and posttest instructions; assignments; goal; glossary; expected learner outcomes; objectives; related Technology Student Association events; academic and workplace applications; impact statements; career information; and an optional activity that could be used for solving problems or reinforcing learning. Topics are as follows: the problem solving system, writing about problem solving, cutting paper to solve specific problems, designing a package that will protect an egg when dropped, building a tall structure using straws and tape, making a budget, and designing a device for walking on ice and snow. (KC)

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ED 380 598

Technology Learning Activity



Technology Education Series

PROBLEM SOLVING

TLA TE-1110

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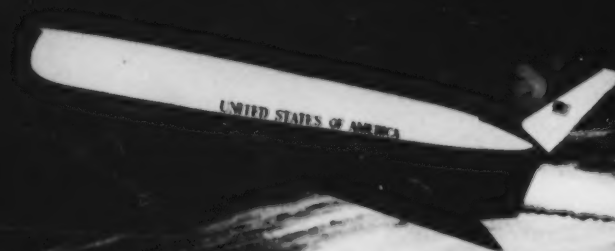
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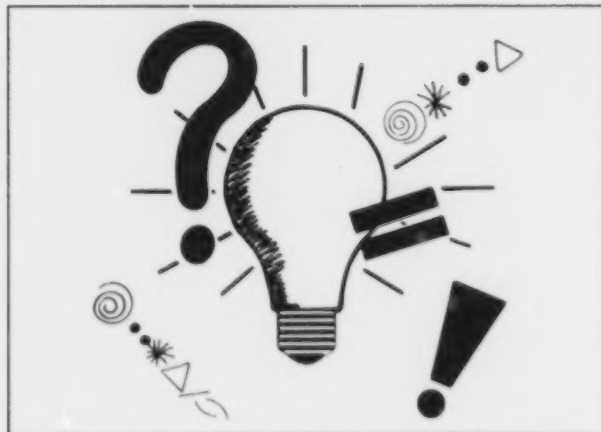
TECHNOLOGY EDUCATION

TECHNOLOGY LEARNING ACTIVITY

TE1110

PROBLEM SOLVING

Suggested Time: 8 Days



Developed by the
Curriculum and Instructional Materials Center
for the Technology Education Division
Oklahoma Department of Vocational and Technical Education

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FOREWORD

What will be the careers of the future? The workforce of tomorrow will be shaped by the technologies being developed today. Students today need accurate, interesting information on growing technologies in order to make informed decisions about their futures.

It is our hope that this curriculum will help improve the quality of career decisions for our students. Students are introduced to a wide range of current, "cutting-edge" technologies and are encouraged to think critically about how those technologies influence their lives and futures. Today's students do not have to become the victims of "technological illiteracy," but instead can learn to anticipate technological developments and take positive steps to prepare for the future.

Technology Learning Activities provide students with the knowledge and an introduction to the skills they need for a positive learning and career experience. Every generation is faced with learning how to manage technological advances. Information gained through participation in the *Technology Education* program can help students develop a holistic view of technology on which to base their educational and career decisions.

*Roy Peters, Jr., Ed.D., State Director
Oklahoma Department of
Vocational and Technical Education*

*Roger Stacy, Ed.D., State Supervisor
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Oklahoma Department of
Vocational and Technical Education*

PREFACE

We believe that one of the most effective ways to improve education is through the development and implementation of a sound instructional materials system. Technology Education instructional materials represent a new design for CIMC which recognizes the importance of graphic materials in the learning process.

Technology Education instructional materials are designed for 6th through 10th grade students. The design of these materials is based on current research on how people read and gain information from documents. The design is called "New Look" and integrates both graphics and text into a balanced presentation which is easy to use and follow.

Technology Education provides the student a look at what the world will be like in the future based on technologies in use and being developed today. Throughout the Technology Education instructional materials, the students are introduced to "cutting-edge" technologies that they will use and encounter in a working environment later in life. This exposure gives them a wide range of experiences on which to base career decisions.

This publication is intended as a starting point, from which the teacher can innovate, localize, and personalize in order to prepare students for their future. The *Technology Education* series of Technology Learning Activities was written with the realization that we are creating the workforce of tomorrow by how and what we teach about technology today.

*Sherry Wietelman, Curriculum Development Specialist
Curriculum and Instructional Materials Center
Oklahoma Department of
Vocational and Technical Education*

*Charles F. Kemnitz, President
Atlatl Communications, Inc.*

ACKNOWLEDGEMENTS

The Curriculum and Instructional Materials Center (CIMC) extends its appreciation to those individuals who played important roles in the development of Technology Learning Activity materials.

Generous thanks is extended to Ron Gregory, Technology Education teacher at Byng Junior High School, for the time, talent and knowledge he contributed in determining the content of this Technology Learning Activity (TLA). We also extend our thanks to him for writing the pilot TLA upon which this TLA was based. A big thank you also goes to Lynn Hawkins and Jim Harder, Technology Education teachers at Mayfield Junior High School, for their technical assistance on this project.

Thank you is also extended to the vocational educators who helped with field testing and contributed their expert input on individualized vocational instructional methods.

Alan Fillmore
Meeker High School

Jerry Lewis
Atoka High School

Ron Givens
Tulsa-Nimitz Middle School

We also thank the State Director, Dr. Roy Peters, Jr., and the Assistant State Director, Dr. Charles O. Hopkins, for their continued support throughout this project.

The school administrators who supported instructor participation in this project and/or allowed their facilities to be used as field test sites in this project deserve a special thank you, as well.

Chris Gillespie
Atoka High School

Brent Walden
Meeker High School

Marolyn Hunnicutt
Tulsa-Nimitz Middle School

Joe Shirley
Mayfield Junior High School

Oklahoma Department of Vocational and Technical Education
Technology Education staff who provided leadership and direction on
this project also deserve special recognition.

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Assistant State Supervisor
Technology Education

Harold Holley
Assistant State Supervisor
Technology Education

Special Recognition and gratitude is expressed to Dr. Charles F. Kernnitz
who trained and coordinated the efforts of a team of technical writers on
this project. His professionalism, dedication and commitment to quality
instructional materials allowed us to design learning activities that
students can readily use to explore new and existing technologies.

Only through the close cooperation of the Curriculum and Instructional
Materials Center staff was this curriculum developed. Sincere thanks are
shared with the CIMC coordinators.

Brenda Stacy, Ed.D.
CIMC Coordinator

Lynna Ausburn, Ph.D.
CIMC Development Coordinator

Special recognition and thanks are also extended to other individuals
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Rose Primeaux and her staff in Word Processing.

Finally, a big thank you to all ODVTE team members who offer their
support on a daily basis in "behind-the-scenes" ways but never seem to
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CIMC secretaries; Karen Heppel and Shirley Hill, Technology Education
secretaries.

*Sherry Wietelman
Curriculum Development Specialist
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TECHNOLOGY EDUCATION OVERVIEW

About the Program

Because the American culture is distinctly characterized as technological, it becomes the function of our schools to give every student an insight into and an understanding of the technological nature of the culture. Technology Education strives to perform this function.

Technology Education in Oklahoma is an instructional program that provides young men and women (grades 6 - 10) with daily, hands-on exploratory experiences and insights into technology and career opportunities so that they can make meaningful occupational and educational choices. It is a program which can enhance the educational experience of all students, whether they are the valedictorian/honor-type student, the middle range/average student, or the student who has found little success in school, namely the at-risk student.

Technology Education acquaints all students with their technological environment so they can make rational decisions about their own lives on a day-to-day basis and participate in controlling their own destiny. The program directs students to related technological and industrial fields, enabling students to realize their full potential and make maximum use of their individual talents in fulfilling career goals in their selected areas of employment.

Technology education capitalizes on the individual's potential for reasoning and problem solving, for imagining and creating, and for constructing and expressing through the use of tools and materials related to technology. It develops content and

TECHNOLOGY EDUCATION OVERVIEW

experiences to contribute to the growth and development of students commensurate with their potential. Thus, Technology Education is a basic and fundamental study for all persons in regard to career explorations and educational opportunities.

Opportunities to develop and apply leadership, social, civic, and technologically related skills are provided through the Technology Student Association (TSA). TSA is the appropriate vocational student organization identified as a teaching tool for teachers to use in assisting students to achieve identified course competencies. Competency-based activities are an integral part of the instructional program.

All Technology Education courses are taught in a one-period block of time (45-55 minutes), with each of the four Technology systems (communication, construction, manufacturing, and transportation, energy and power) being designed to provide a means through which other courses such as math, science, English, and social studies can be applied in a practical manner within a technology-based situation. Teaching across the curriculum is vital to the success of a Technology Education program.

TECHNOLOGY EDUCATION OVERVIEW

About the TLAs

The *Technology Education* series consists of 40 Technology Learning Activities (TLAs) for instruction and a supplemental activities book. Each TLA is divided into two parts: an instructor's guide and a student guide. The instructor's guide provides an overview of Technology Education, a summary of activities and supplies needed for students to complete the Technology Learning Activity, a supplies and materials worksheet for the instructor, an overview of the particular TLA, written exam answer sheets, and evaluation summary for the TLA.

Master copies of the evaluation summary sheets, pretest and posttest, and supplies and materials worksheets are provided with this instructors edition of the TLA. These sheets may be reproduced for classroom use.

All of the TLAs focus on measurable and observable learning outcomes. Instructors are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

TLAs are designed for use in more than one class period of instruction. Careful study of each TLA by the instructor will help her or him determine the following:

- Skills to demonstrate
- Supplies and equipment needed

TECHNOLOGY EDUCATION OVERVIEW

- Amount of time needed for student practice
- Workstation Bookshelf, Instructor's Reference Materials, and a bibliography are provided for supplemental resources
- Supplementary materials, including print and non-print media to order
- Resource people to contact
- Facility modifications which may be necessary to administer the TLA

Each TLA is based on performance objectives. Performance objectives are specific, stating the performances necessary to meet the goal of the TLA.

The overall goal of the unit tells what the student should be able to do and what standard will be used to determine whether the student has achieved competency. The specific objectives outline the sequence of the competencies required to meet the TLA goal. The competencies may be either cognitive, requiring knowledge only, or psychomotor, requiring knowledge and skill.

TECHNOLOGY EDUCATION OVERVIEW

About Ordering TLAs

Additional TLAs in the *Technology Education* series may be ordered through the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, OK 74074-4364. Phone 1-800-522-5810.

NOTE: The 1100- and 1200-series numbers given on the next page are for ordering TLA Instructor's Editions; to order Student Editions, change the first two numbers to 31 (for 8-Day TLAs) or 32 (for 6-Week TLAs).

TECHNOLOGY EDUCATION OVERVIEW

TLA Title	Order No.
8-DAY TLAs	
Aerospace and Flight	TE1117
Agricultural Education	TE1123
Audiovisual Programming	TE1131
CAD — Autocad Release 10	TE1114
Career Search	TE1104
Drafting	TE1134
Electricity — Principles and Applications	TE1105
Electronic Publishing	TE1135
Electronics (CES)	TE1106
Fluidics Technology	TE1116
Health Occupations	TE1124
Home Economics	TE1125
Introduction to Votech	TE1122
Introduction to Animation	TE1132
Keyboarding and Computer Application	TE1115
Laser/Fiber Optics/Holography	TE1129
Lasers Technology	TE1103
Marketing Education	TE1126
Material Processes — Plastics	TE1133
NASA Aerospace-Spacelink	TE1111
Photography	TE1130
Problem Solving	TE1110
Research and Design	TE1101
Residential Construction	TE1121
Robotics — Control Technology	TE1112
Robotics — ProArm	TE1113
Safety	TE1107
Structural Engineering	TE1102
Synergetic Technology	TE1120
Technical Report Writing	TE1118
Technology Challenge	TE1109
Thermal Screen Printing	TE1119
Trade and Industrial Education	TE1127
TSA Leadership	TE1108
Vocational Business	TE1128
6-WEEK TLAs	
Animator	TE1203
CAD/Board Drafting	TE1201
Control Technology	TE1202
Electronics/Electricity/Robotics	TE1204
Electronic Publisher	TE1205

TECHNOLOGY EDUCATION OVERVIEW

Corrections and Suggestions

CIMC wants to provide Technology Education instructors and students materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications or have suggestions for improving their usefulness, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and indicate the correction on the copy. Mail this information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, notify the CIMC of necessary corrections as soon as possible. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

*Curriculum Development Coordinator
Curriculum and Instructional Materials Center
Oklahoma Department of Vocational and
Technical Education
1500 West Seventh Avenue
Stillwater, Oklahoma 74074-4364*

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Background Information

Expected Learner Outcomes

INSTRUCTOR'S SECTION

The background information component provides instructors with basic information about the subject of the TLA. Instructors are encouraged to use suggested resources for additional information on the specific technology used in each TLA.

There are 19 Expected Learner Outcomes for the *Technology Education* series. Not every TLA fulfills all 19 Expected Learner Outcomes, so outcomes specific to each TLA are listed in the Instructor's Section and in the Student's Section. The 19 Expected Learner Outcomes for the *Technology Education* series are:

- ◆ The student will know and appreciate the importance of technology and technological literacy.
- ◆ The student will explore career opportunities so they can make meaningful occupational choices.
- ◆ The student will explore future educational opportunities so they can make meaningful educational choices.
- ◆ The student will apply problem solving and critical thinking techniques.
- ◆ The student will apply math, science, reading, and other school subjects in a practical situation.
- ◆ The student will develop keyboarding and computer literacy skills.

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INSTRUCTOR'S SECTION

- ◆ The student will develop basic skills in the safe and proper use of tools, machines, materials, processes, and technical concepts.
- ◆ The student will recognize and develop individual talents.
- ◆ The student will think logically and sequentially.
- ◆ The student will develop leadership, creative abilities, positive self-concepts, and individual potential in a technological society.
- ◆ The student will become a more sophisticated consumer of the goods and services of a technological society.
- ◆ The student will adjust to a changing technological environment.
- ◆ The student will develop an understanding and the ability to adapt to those technological forces that influence life in the 21st Century.
- ◆ The student will develop an understanding of economic development.
- ◆ The student will communicate by making clear and relevant points through the development of mental process skills.

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INSTRUCTOR'S SECTION

- ◆ The student will apply design, imagination, and creative abilities.
- ◆ The student will learn applications of lifelong learning skills.
- ◆ The student will think globally and act locally.
- ◆ The student will explore the organization and management systems of business and industry.

Suggested Activities

The suggested activities component is to assist during the preparation stage of the teaching/learning process. The activities provide suggestions for preparation and evaluation during the instructional process. The instructor should read the suggested activities before assigning the TLAs to allow time to obtain supplemental materials, prepare audiovisual materials, and contact outside resource persons. Duties of the instructor will vary according to the particular TLA.

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Suggested Resources

Instructional Sequence

Equipment, Tools, and Supplies: Summary Worksheet

INSTRUCTOR'S SECTION

Suggested resources include people and print and non-print media that may be used with the TLA. References used during the development of each TLA are also provided. The instructor can use suggested resources and TLA references to supplement her or his knowledge of the subject to help students with particular interests or objectives in the area covered. Please note that suggested resources and references listed in this publication existed when this publication was written. CIMC assumes no responsibility for providing these materials and cannot ensure the availability of these materials as individual vendors, manufacturers, and publishers may discontinue these products at any time.

This component provides instructors with daily lesson plans for the TLA. Included in the instructional sequence component are suggested daily assignments and equipment, tools, and supplies that will be needed for each student. A column for facility requirements or modifications is provided for each instructor. This component is provided as a guide to plan for and monitor students' progress through the TLA.

This component is provided as a planning tool for instructors. It provides instructors with a list of the necessary equipment, tools and supplies to support student activities and provides specific information for budgeting purposes.

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Pretest and Posttest

Test Answers

Evaluation Summary

INSTRUCTOR'S SECTION

These components provide criterion-referenced evaluation of the objectives listed in each TLA. If objectives or activities have been added, deleted, or modified, appropriate changes should be made on the tests.

This component is provided to assist instructors in evaluating student performance on written tests.

This component is provided to assist instructors in summarizing the performance of each student on an individual basis. The evaluation summary forms are also provided as photocopy masters for the instructors use.

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Introduction

Summary of Activities

STUDENT'S SECTION

Daily activities are the step-by-step procedures students will follow to complete the learning experience. Each TLA is organized by daily tasks and activities. Students are able to pace their progress through the TLA by referring to the activities for the day.

Within the daily activity pages are components common to all TLAs.

A Summary of Activities page begins each day of the TLA. This page provides several important pieces of information for both the student and instructor.

- ①** In the left column this page provides the student with a list of activities to be accomplished that day.
- ②** In the right column the major Academic and Workplace Application which applies to that day's activities is graphically indicated with a standard icon.
- ③** Below the icon is a list of specific skills reinforced during that day's activities.

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Pretest Instructions

STUDENT'S SECTION

The students are required to take a Pretest as one of the first day's activities. The instructions for the Pretest are given in this section.

Assignments to Turn In

Day One includes a list of all assignments the students are expected to turn in during or at completion of the TLA. This list includes all tests, activities, and products covered in the TLA.

Goal

On Day One, following the assignments checklist, is a concise statement of the overall goal of the TLA. This statement summarizes the purpose for completing the TLA and encourages the student to think about the broader implications of the learning experience.

Words You Should Know

The first day's activities includes a glossary of unfamiliar technical terms used in the TLA. Often these terms are necessary for the student in order to accurately follow instructions in the activity procedures. The students should be encouraged to review this glossary and refer to it often during the course of the TLA.

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Expected Learner Outcomes Reinforced by this TLA

STUDENT'S SECTION

As stated in the guide to the Instructors Section, there are 19 identified Expected Learner Outcomes associated with the *Technology Education* series. This section of Day One activities lists the Expected Learner Outcomes that specifically apply to the TLA. A student who reviews this list will gain a better understanding of the scope of experiences and skills to be gained from the TLA.

Objectives

Each TLA is made up of a set of measurable objectives. In this section on Day One, students are given a list of all the objectives addressed in the TLA. This list can serve to introduce students to the "flow" of the TLA as they build introductory skills in a technology.

Related TSA Competitive Event(s)

Each TLA may be used by students to begin work toward completion of a Technology Student Association competitive event. Some TLAs are tied to a specific TSA event; other TLAs may be used with several events. This Day One section gives the student and instructor a list of appropriate TSA events which the TLA may support.

TSA competitive events promote leadership development, and an understanding that winning isn't everything but involvement is. Events are staged at Local, Regional, State, and National levels through which the student may progress.

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Academic and Workplace Applications

Preparing students to enter successfully into today's world ...

... emergence of a renewed emphasis on basic academic skills ...

STUDENT'S SECTION

The curricular content and activities found in this Technology Learning Activity help students apply academic and workplace competencies. These competencies include: Reading Skills, Writing Skills, Mathematics Skills, Science Skills, Oral Communications Skills, Interpersonal or Relating Skills, Creative Thinking and Problem Solving Skills, Employability Skills, and Social Studies Skills.

Preparing students to enter successfully into today's world of work offers vocational education a substantial challenge. The contemporary workplace is characterized by constant and rapid technological change and by increasing job complexity and skill intensity. Due to rapid technological advancement, the half-life of work skills is now reduced to a bare three to five years. Out of this new workplace environment has arisen a growing national awareness of the critical importance of an American workforce armed with the skills necessary to survive in a competitive economy.

One result of this national awareness has been the emergence of a renewed emphasis on basic academic skills in all areas of education. Pressure to increase academic skill development is being placed on education by both legislative action and industry mandate. The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 sets stringent academic and workplace skill requirements for vocational education. State legislatures are increasingly requiring basic skills accountability by teachers and school administrators.

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... expected learner outcomes are being implemented with increasing frequency.

The issue of basic skills ... was successfully addressed in a national three-year study ...

... research indicates clearly that American employers ... need a variety of skills ...

STUDENT'S SECTION

Graduation exams, minimum competency requirements, and expected learner outcomes are being implemented with increasing frequency. In addition, business and industry are delivering the message clearly to educators that vocational competence now requires increased strength in academic and workplace skills.

The issue of the basic skills currently required in the work place was very successfully addressed in a national three-year study conducted jointly by the American Society of Training and Development (ASTD) and the U.S. Department of Labor (DOL). The findings of this study were published in 1990 in the book, *Workplace Basics: The Essential Skills Employers Want*.

The ASTD/DOL research indicates clearly that American employers have discovered that their workforces need a variety of skills that include, but are not limited to, the classic academic trio of reading, writing, and computation. Employers now are also looking for competence in areas such as "learning to learn," problem solving and critical thinking, interpersonal and teamwork skills, oral communication and listening techniques, and the social and personal management skills that demonstrate a capacity for independence and responsibility in on-the-job performance.

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... business and industry have expanded and re-defined "workplace basics."

CIMC materials contain information and activities which develop academic and workplace application competencies ...

To assist teachers and students in identifying activities which promote academic and workplace skills ...

STUDENT'S SECTION

It is clear that the requirements of today's business and industry have expanded and re-defined "workplace basics." It is in line with this re-definition, and with the competency requirements of current education legislation, that the Oklahoma Department of Vocational and Technical Education has chosen to address "basic skills" in the instructional materials produced by its Curriculum and Instructional Materials Center.

It is not a new development for CIMC materials to contain information and activities which develop academic and workplace application competencies in students undertaking vocational programs. What is new is the specific marking, or flagging, of items in our instructional materials that address academic and workplace application skills.

To assist teachers and students in identifying activities which promote academic and workplace skills development, CIMC has implemented a marking system which uses simple graphic symbols, or icons. These icons are located in the right margins of Activity Sheets. The following is an explanation of the icons and the kinds of academic and workplace application activities they indicate.

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READING SKILLS:

Skills involving use of print resource material for

obtaining and applying information.



WRITING SKILLS:

Skills involving written communication of

processes, information, or ideas.



MATH-EMATICS SKILLS:

Skills involving computation, calculation,

and interpretation of numerical data.

STUDENT'S SECTION

Current vocational education literature indicates that functional literacy as a workplace basic needs to be defined in terms of reading competencies actually required for job performance. The activities identified with this icon as addressing reading skills in CIMC materials deal specifically with developing reading skills in an applied, job-related context. These range from general information-gathering activities to tasks requiring use of specific technical reference materials. Many contain a "learning to learn" aspect, which promotes engaging actively and purposefully in vocationally relevant enquiry.

Tasks identified with this icon promote development of skills in written communications. As with reading skills, the writing skills emphasized in CIMC materials have a vocational context. They include filling out forms, keeping work activity records, writing simple memos and letters, generating more complex reports and articles, and written expression of ideas and concepts related to vocational performance or exploration.

This icon identifies activities which develop vocationally-related skills in computation, measurement and estimation, selection and application of appropriate mathematical processes, and collecting, displaying, or interpreting data.

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SCIENCE SKILLS:
Skills involving mastery and application of scientific

information or theory.



ORAL COMMUNICATION SKILLS:

Skills involving speaking

and listening.



INTERPERSONAL OR RELATING SKILLS:

Skills involving

working and getting along with others.

STUDENT'S SECTION

This icon marks activities which are related to the development of skills in either the physical or biological sciences. These skills stress occupationally-related applications of science and technology.

Activities marked with this icon promote development of effective speaking and listening. They include practice in such areas as speaking techniques, word choice, non-verbal messages, use of communication media, and using active listening techniques. Many of these activities promote "learning to learn" skills in verbal enquiry.

Activities which deal directly with skills in relating to others are marked with this icon. This includes areas such as multi-cultural awareness, group processes and dynamics, negotiation, dealing with conflict, cooperation and teamwork, values and attitudes, and leadership and motivation.

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CREATIVE THINKING AND PROBLEM SOLVING SKILLS:

Skills

involving comprehending, applying, analyzing, and developing complex ideas and situations.



EMPLOYABILITY SKILLS:

Skills involving choosing, obtaining,

and succeeding in a career.



SOCIAL STUDIES SKILLS:

Skills involving investigation and

application of social concepts.

STUDENT'S SECTION

This icon identifies activities which stress development of higher-order thought processes such as problem identification and analysis, lateral thinking, evaluating alternatives, developing solutions, examining assumptions, and evaluating outcomes.

Activities marked with this icon relate to competencies required to obtain employment and develop a career. These competencies include specific occupational tasks. They also include items such as career analysis and selection, job searching, completing applications and resumes, interviewing, and business etiquette and personal management skills required for job-keeping and maturing in one's work. Examples of the latter category include personal presentation, self-discipline, work accuracy, reliability, discretion, punctuality, stress handling, judgement, confidence, etc.

This icon marks activities which stress competencies in fields relating to human society and its distribution and relationships. This includes areas such as history, geography, government and politics, economics, psychology, sociology, demographics, current events, cross-cultural studies, consumer issues, environmental issues, and ethical concerns in science and technology.

USING THIS PUBLICATION

Impact Statements

STUDENT'S SECTION

There are five areas of human culture that each TLA impacts. These impact statements appear during Day Eight, after the student has gained some familiarity with the technology.

- ① **ENVIRONMENTAL IMPACT:** A statement introducing the student to the impact of the technology on the environment.
- ② **SOCIAL/CULTURAL IMPACT:** A statement concerning the impact of the technology on society and culture.
- ③ **ECONOMIC IMPACT:** A statement concerning the impact of the technology on the economy.
- ④ **POLITICAL IMPACT:** A statement concerning the impact of the technology on politics, laws, and regulations, and the impact of politics on the development of the technology.
- ⑤ **ERGONOMIC IMPACT:** A statement concerning the ergonomic implications of the technology. Ergonomics is the study of developing products and systems that meet peoples' needs.

USING THIS PUBLICATION

STUDENT'S SECTION

Impact Statements offer the student the opportunity to see beyond the activities in the Technology Learning Lab and glimpse the real-world applications of the technology.

Career Search

Also on Day Eight, the students are given the assignment of investigating several career opportunities related to the technology of the TLA. The investigation is done with *Career Search Abstracts*. A list of up to five related careers is given, followed by pages from *Career Search Abstracts* that detail the career qualifications and work environment. The student is required to choose two related careers, read the appropriate abstracts, then write a short essay about why that career may be appealing.

Posttest Instructions

The students are required to take a Posttest as one of the last day's activities. The instructions for the Posttest are given in this section. The score for the Posttest, compared to the score for the Pretest may be compared to help determine the student's gain during the TLA.

USING THIS PUBLICATION

Skunk Works

STUDENT'S SECTION

Skunk Works, a Day Eight optional activity, include instructions that could be used for solving problems or reinforcing the enrichment of learning.

The term Skunk Works was coined by engineers at 3M Corporation in the mid-1960s. Some engineers wanted to develop a new product, but company management would not give them the time or money to work on the project. So the engineers "borrowed" time and money from approved projects to work on their "Skunk Works." When they finished developing the product, they presented it to management and it has been a 3M product ever since. The product: Velcro fasteners.

HAZARD ALERT MESSAGES

The Daily Activities include hazard alert information specific to the Activity. These messages should be discussed carefully and thoroughly. The Hazard Alert Message system used in the TLA is based on the American National Standards Institute (ANSI) Standard Z535, which provides for five levels of alert.

Students are introduced to the ANSI Hazard Alert Message system as an activity in the Safety TLA (TE1107/TE3107). This system was adopted by ANSI as the standard in 1990 and will be the hazard alert system in use when students reach the workplace.

Hazard Alert Messages in the TLA are indicated both by the color red and graphically. There are three types of hazard alert graphics used in the TLA:



Hazard Alert
Symbol

This Hazard Alert Symbol is used with the words DANGER, WARNING, and CAUTION. ANSI defines these words as:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

HAZARD ALERT MESSAGES



Injury Hazard
Graphic



Avoidance
Graphic

There are two types of graphics used in conjunction with the hazard alert symbol. This type of graphic depicts a specific injury that may be expected if the hazard described in the alert is not avoided.

This second type of graphic is called an avoidance graphic. It depicts an action the student should take in order to avoid injury.

There are two other ANSI words used in the TLAs and the students should understand their meanings:

NOTICE indicates an action that could result in damage to property or equipment.

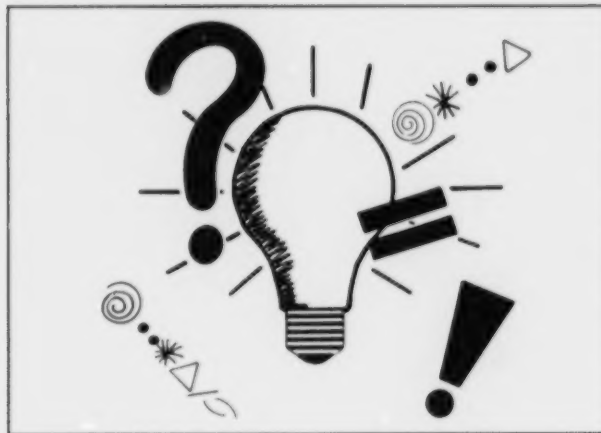
IMPORTANT indicates an instruction that can help the student do a better job.

TECHNOLOGY EDUCATION

PROBLEM SOLVING

TE1110/TE3110

INSTRUCTOR'S SECTION



BACKGROUND INFORMATION

The Problem Solving TLA will introduce students to the Problem Solving System. This is a systematic approach to problem solving that can be applied to almost any situation.

Students should be encouraged to use the Problem Solving System with other TLAs when appropriate. Students may also be able to apply the system to problems in other areas of their lives.

INSTRUCTOR'S SECTION

SUGGESTED ACTIVITIES

- ✓ Obtain materials to supplement unit.

NOTE: See Suggested Resources.

- ✓ Review instructional outline for this TLA. Modify time frames to suit class needs and plan activities for each class period.
- ✓ Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- ✓ Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- ✓ Determine how you will schedule time for students to demonstrate competence in the required procedures.

INSTRUCTOR'S SECTION

PREPARATION

SUGGESTED RESOURCES

Gregory, Ron. *Problem Solving and Technology Education*, 1990.

Hacker, Michael and Robert Barden. *Living with Technology*, Mission Hills, CA: Glencoe Publishing Company, 1982.

Micklus, C. Samuel. *Problems! Problems! Problems!*, Glassboro, NJ: Creative Competitions, Inc., 1990.

Technology Education: Introduction to Technology, Albany, NY: The University of the State of New York, 1987.

INSTRUCTOR'S SECTION

REFERENCES

LESSON PLAN

INSTRUCTOR'S SECTION

Instructional Sequence	Technology Education: Problem Solving		
	Assignments	Equipment, Tools, and Supplies	Facilities Requirements/ Modifications
Day 1	Take Pretest Complete Career Search Assignment Read and Study Objectives, Student Learner Outcomes, Related Academic and Workplace Skills, Implications, and Information Sheets	Computer score card sheet for Pretest #2 pencil	
Day 2	Write a one page essay on a problem you have solved in the past Cut an 8.5 X 11" sheet of paper so that it can be stretched over the longest distance possible	Paper, 8.5 X 11", 2 Pen or pencil Scissors Tape Yardstick or tape measure	
Day 3	Design 2 packages that will allow an egg to be dropped 3 feet without cracking	Paper, 8.5 X 11", 3 Pencil	
Day 4	Build and test one egg package designed previously	Completed design Fresh egg, 1 Popicle sticks, 10 Drinking straws, 15 Masking tape, 36" Paper towels, 3 Plastic wrap Scissors Stapler Yardstick or tape measure	
Day 5	Design and build a structure to hold a tennis ball for at least 30 seconds	Paper, 8.5 X 11", 3 Pencil Tennis ball Drinking straws, 30 Masking tape, 24" Yardstick or tape measure	

LESSON PLAN

INSTRUCTOR'S SECTION

Instructional Sequence	Technology Education: Problem Solving		
	Assignments	Equipment, Tools, and Supplies	Facilities Requirements/ Modifications
Day 6	Given income and expenses, create a budget. Adjust budget to cover new expense.	Paper, 8.5 X 11, 3 Pencil or pen Calculator (opt.)	
Day 7	Design a device to allow people to walk on ice in normal shoes without slipping.	Paper, 8.5 X 11, 3 Pencil	
Day 8	Complete any incomplete assignments. Take Posttest. Complete (1) Problem Solver if all other work has been completed.	Computer score sheet card #2 pencil For Problem Solver Bricks or wooden blocks, 4	

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SUMMARY WORKSHEET

INSTRUCTOR'S SECTION

Equipment, Tools, and Supplies: Summary Worksheet

Equipment, Tools, and Supplies	Per Student	Per Period	Total Needed	Special Considerations	Cost per Student	Cost per Period	Total Cost	Special Considerations
Computer score sheet card or notebook paper	1 card or 3 sheets							
#2 Pencil	1							
Paper, 8.5 X 11"	13							
Scissors	1							
Stapler	1							
Staples	as needed							
Tennis ball	1							
Drinking straws	45							
Popsicle sticks	10							
Masking tape	60"							
Paper towels	3							
Plastic wrap	1 roll							
Calculator (optional)	1							
Yardstick or tape measure	1							
Fresh egg	1							
Bricks or wooden blocks	4							

PRETEST

1. Trial and error is the best way to solve any problem.
 - a) True
 - b) False
2. The first step in the problem solving system is setting a goal.
 - a) True
 - b) False
3. The specifications for an individual problem tell you what conditions the solution must meet.
 - a) True
 - b) False
4. Brainstorming is a problem solving method often used in a group.
 - a) True
 - b) False
5. Problems are never solved by accident.
 - a) True
 - b) False
6. Instead of coming up with different solutions, you should follow your first instinct and concentrate on the first solution that comes to mind.
 - a) True
 - b) False

INSTRUCTOR'S SECTION

PRETEST PART 1

PRETEST

7. Feedback is when you ask people if they think your solution will work before you try it.
 - a) True
 - b) False
8. After a problem is solved, the solution should be evaluated to make sure it is complete and correct.
 - a) True
 - b) False
9. You must define a problem before you can solve it.
 - a) True
 - b) False
10. When solving a problem, you should always consider your own experiences instead of the past experiences of others.
 - a) True
 - b) False

INSTRUCTOR'S SECTION

PRETEST PART 2

POSTTEST

11. Trial and error is the best way to solve any problem.
 - a) True
 - b) False
12. The first step in the problem solving system is setting a goal.
 - a) True
 - b) False
13. The specifications for an individual problem tell you what conditions the solution must meet.
 - a) True
 - b) False
14. Brainstorming is a problem solving method often used in a group.
 - a) True
 - b) False
15. Problems are never solved by accident.
 - a) True
 - b) False

INSTRUCTOR'S SECTION

POSTTEST PART 1

POSTTEST

16. Instead of coming up with different solutions, you should follow your first instinct and concentrate on the first solution that comes to mind.
 - a) True
 - b) False
17. Feedback is when you ask people if they think your solution will work before you try it.
 - a) True
 - b) False
18. After a problem is solved, the solution should be evaluated to make sure it is complete and correct.
 - a) True
 - b) False
19. You must define a problem before you can solve it.
 - a) True
 - b) False
20. When solving a problem, you should always consider your own experiences instead of the past experiences of others.
 - a) True
 - b) False

INSTRUCTOR'S SECTION

POSTTEST PART 2

POSTTEST

- 21. fluorocarbons
- 22. insite
- 23. brainstorming
- 24. feedback
- 25. empliment

INSTRUCTOR'S SECTION

SPELLING TEST

TEST ANSWERS

- | | |
|-----|---|
| 1. | B |
| 2. | B |
| 3. | A |
| 4. | A |
| 5. | B |
| 6. | B |
| 7. | B |
| 8. | A |
| 9. | A |
| 10. | B |
| 11. | B |
| 12. | B |
| 13. | A |
| 14. | A |
| 15. | B |
| 16. | B |
| 17. | B |
| 18. | A |
| 19. | A |
| 20. | B |
| 21. | A |
| 22. | B |
| 23. | A |
| 24. | A |
| 25. | B |

INSTRUCTOR'S SECTION

PRETEST ANSWERS

POSTTEST ANSWERS

EVALUATION SUMMARY

10 POINTS EACH

Pretest Score _____

Career Search Activity _____

Activity 1: Cut a 8 1/2" X 11" piece of paper in such a way that it can be stretched over the longest distance possible. _____

Activity 2: Write a one-page essay, using correct grammar and spelling, on how you have solved a problem in the past. _____

Activity 3: Design at least two, and build one package, using only the materials given, that will protect an egg from cracking when dropped from a height of three feet. _____

Activity 4: Design at least two, and build one tallest possible structure, using only the materials given, that will support a tennis ball for 30 seconds. _____

Activity 5: Given an income and required and optional expenses, design a monthly budget. _____

Activity 6: Adjust the budget to cover a new expense. _____

INSTRUCTOR'S SECTION

1. PROCESS EVALUATION



EVALUATION SUMMARY

20 POINTS EACH

Activity 7: Design a device that will allow people to walk on ice and snow, wearing normal shoes, without slipping. _____

INSTRUCTOR'S SECTION

1. PROCESS EVALUATION (Continued)

1. PROCESS
EVALUATION
SCORE _____

EVALUATION SUMMARY

The instructor is encouraged to individualize the TLA to address the specific needs of each student, considering age and ability level. In addition to the specific devices designed and constructed, the instructor should take into account the student's desire, enthusiasm, etc.

Evaluation based upon design and observed performance = 60 possible points.

INSTRUCTOR'S SECTION

2. PRODUCT EVALUATION

EVALUATION RATING TABLE

Student Name: _____

Criteria	Points Possible	Points Earned
<u>Objective 4:</u>		
Design creativity	10	_____
Design appearance	10	_____
Design implementation (Did the egg break?)	10	_____
<u>Objective 5:</u>		
Design creativity	10	_____
Design appearance	10	_____
Design implementation (Did it support the ball?)	10	_____

2. PRODUCT
EVALUATION
SCORE _____

EVALUATION SUMMARY

Use the conversion table below to convert
Product Evaluation scores to percentiles.

60 = 100%
59 = 98%
58 = 97%
57 = 95%
56 = 93%

55 = 92%
54 = 90%
53 = 88%
52 = 87%
51 = 85%

50 = 83%
49 = 82%
48 = 80%
47 = 78%
46 = 77%

45 = 75%
44 = 73%
43 = 72%
42 = 70%
41 = 68%

40 = 67%
39 = 65%
38 = 63%
37 = 62%
36 = 60%

INSTRUCTOR'S SECTION

2. PRODUCT EVALUATION (Continued)

CONVERSION TABLE

EVALUATION SUMMARY

Posttest score _____

EVALUATION WORKSHEET

1. Process evaluation score = _____

2. Product evaluation score = _____

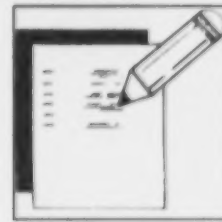
3. Written evaluation score = _____

4. Total score = _____

Divide Total Score by 3.

INSTRUCTOR'S SECTION

3. WRITTEN EVALUATION



3. WRITTEN
EVALUATION
SCORE _____

Total score for TLA =

$$1 + 2 + 3 = 4$$

Total score / 3 =
TLA Score

TLA SCORE _____

BIBLIOGRAPHY

Gregory, Ron. *Problem Solving and Technology Education*, 1990.

Hacker, Michael and Robert Barden. *Living with Technology*, Mission Hills, CA: Glencoe Publishing Company, 1982.

Micklus, C. Samuel. *Problems! Problems! Problems!*, Glassboro, NJ: Creative Competitions, Inc., 1990.

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INSTRUCTOR'S SECTION

TECHNOLOGY

LEARNING

ACTIVITY

TE3110

PROBLEM SOLVING

Suggested Time: 8 Days



Developed by the
Curriculum and Instructional Materials Center
for the Technology Education Division
Oklahoma Department of Vocational and Technical Education

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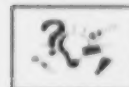
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TECHNOLOGY EDUCATION PROBLEM SOLVING

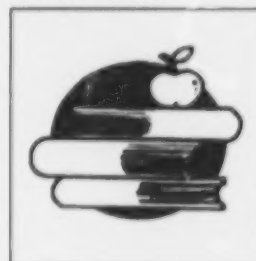
DAY 1 ACTIVITIES



On Day 1 you should complete the following activities:

- 1 Complete Pretest
- 2 Read Assignments to Turn In (items to complete in 8 days)
- 3 Read Goal
- 4 Read Words You Should Know
- 5 Read Expected Learner Outcomes
- 6 Read Objectives
- 7 Read Related TSA Competitive Events
- 8 Read Academic and Workplace Applications
- 9 Read the Information Sheets.

SUMMARY OF ACTIVITIES



Reading Comprehension Skills:

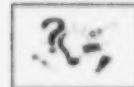
- ◆ Gain factual information
- ◆ Make generalizations

Functional Reading Skills:

- ◆ Follow written instructions
- ◆ Interpret graphics and symbols
- ◆ Use content area vocabulary

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES

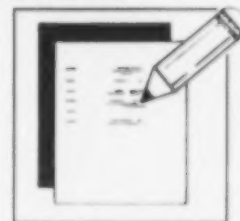


You will need a computer scan sheet or card to record your answers to the following Pretest. Be sure to write your name, the title of the TLA, the date, and the class period on the computer scan sheet or card using a #2 pencil. Use rows 1-10 to record the answers to the Pretest. If your answers will be hand-scored, use a blank sheet of notebook paper to record your answers and number your answers 1-10.

Get Pretest Questions from your instructor.

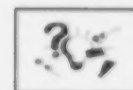
PRETEST

DIRECTIONS



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



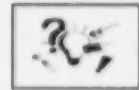
At the end of 8 days, you should give the following items to your instructor for evaluation:

1. Computer score card/sheet, with answers to:
 - a) Prefest
 - b) Posttest
2. Career Search Activity
 - a) Two occupations identified
 - b) Explanation of why those occupations appealed to you.
3. Two designs each (rough sketches) for:
 - a) The Egg Drop Package
 - b) The Leaning Tower of Tennis Ball
 - c) The Ice Walker
4. Completed Egg Drop Package and Leaning Tower of Tennis Ball
5. Completed budget:
 - a) The original budget
 - b) The revised budget
6. Problem Solving Essay
7. Paper Stretching Activity
 - a) The paper you cut
 - b) How far you stretched the paper

ASSIGNMENTS TO TURN IN

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES

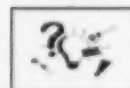


The Problem Solving TLA will help you learn about systematic ways of solving problems. You will solve different types of problems and examine the methods you used to solve them. Many of your problems will be similar to those faced by business and industry.

GOAL

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



Accident — event happening by chance or from an unknown cause.

Brainstorming — a group method of problem-solving that calls upon members of the group to spontaneously contribute ideas.

Feedback — information about something that helps you to evaluate an action or process.

Insight — seeing a problem intuitively or with a unique perspective.

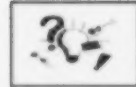
Past experience — this is a tool in solving a problem. By remembering something that you experienced previously, you use that knowledge to eliminate possible solutions and develop possible solutions.

Trial and error — method of solving a problem where you try one possible solution to see if it succeeds or fails. If it fails, you try another possible solution and keep trying solutions until one succeeds or you determine there is no solution.

WORDS YOU SHOULD KNOW

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



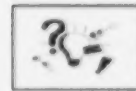
Expected Learner Outcomes reinforced by this TLA are:

EXPECTED LEARNER OUTCOMES

- You will explore career opportunities so you can make meaningful occupational choices.
- You will apply problem-solving and critical thinking techniques.
- You will apply math, science, reading, and other school subjects in a practical situation.
- You will develop basic skills in the safe and proper use of tools, machines, materials, processes, and technical concepts.
- You will recognize and develop individual talents.
- You will think logically and sequentially.
- You will develop leadership, creative abilities, positive self-concepts, and individual potential in a technological society.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



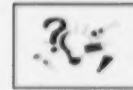
EXPECTED LEARNER OUTCOMES

(Continued)

- You will become a more sophisticated consumer of the goods and services of a technological society.
- You will adjust to a changing technological environment.
- You will develop an understanding and the ability to adapt to those technological forces that influence life in the 21st Century.
- You will communicate by making clear and relevant points through the development of mental process skills.
- You will apply design, imagination, and creative abilities.
- You will learn applications of lifelong learning skills.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



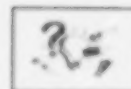
At the completion of this Technology Learning Activity, the student should be able to:

OBJECTIVES

1. Write a one-page essay, using correct grammar and spelling, on a problem you have solved in the past.
2. Cut an 8 1/2" by 11" piece of paper in such a way that it can be stretched over the longest distance possible without breaking and measure the distance it is stretched.
3. Design two packages and build one, using only the materials given, that will protect an egg from cracking when dropped from a height of three feet.
4. Design and build the tallest possible structure, using only the materials given, that will support a tennis ball for at least 30 seconds.
5. Given a limited income and required and optional expenses, design a monthly budget.
6. Adjust the budget to cover a new expense.
7. Design a device that will allow people to walk on ice and snow, wearing normal shoes, without slipping.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



The following TSA Competitive Event
applies to your study of Problem Solving:

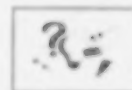
➤ Technology Problem Solving

See *TSA Competitive Events Guidelines* for
specific details on the competitions.

Related TSA Competitive Event

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



Technology Education Courses are designed to provide a means through which other courses, such as Math, Science, English, and Social Studies, can be applied in a practical manner within a technology-based situation. You are provided the opportunity to apply academic and workplace skills which you will need to function in a technological society.

Even though each of the nine Academic and Workplace areas is applicable to Problem Solving and the content of this TLA, the following competencies are specifically reinforced:

Language Arts Concepts Applied:

Reading Comprehension Skills:

- ◆ Gain factual information
- ◆ Make generalizations

Functional Reading Skills:

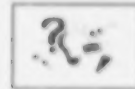
- ◆ Follow written instructions
- ◆ Interpret graphics and symbols
- ◆ Use content area vocabulary

ACADEMIC AND WORKPLACE APPLICATION



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



Math Concepts Applied:

Functional Math Skills:

- ◆ Prepare a budget
- ◆ Solve income/expense problems



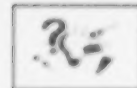
Creative Thinking/Problem-Solving Concepts Applied:

- ◆ Define a problem
- ◆ Identify/develop alternatives
- ◆ Evaluate alternatives
- ◆ Select an alternative
- ◆ Evaluate results/outcomes



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



INFORMATION SHEET

INFORMATION

There are many different ways of solving problems. One common method is trial and error — keep trying different solutions until one of them works. Another is to ask people who have had a similar problem in the past and do what they did to solve it. These techniques are often all you need to solve a problem, especially a simple one.

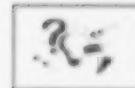
However, they are actually steps in a larger, more complete problem solving process called the Problem Solving System. The Problem Solving System consists of these steps:

- | | |
|---------|--|
| Step 1. | Define the problem. |
| Step 2. | Set goals and consider the specifications. |
| Step 3. | Develop alternatives. |
| Step 4. | Select the best solution. |
| Step 5. | Implement the solution. |
| Step 6. | Evaluate the results. |

THE PROBLEM SOLVING SYSTEM

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



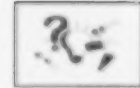
Defining the problem is a step many people skip. However, it is important to know exactly what you are trying to solve, especially if you are working with other people. If you do not think carefully about the problem, you may not come up with a complete solution.

For example, one of the problems you will solve in this TLA is to design and build a package for an egg. To completely solve the problem, the package must allow an egg to be dropped three feet without breaking.

1. DEFINE THE PROBLEM

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



Once you have defined your problem, you must decide what you want to accomplish. One problem may present several goals. For example, with the egg package, your goals may be to have fun, impress your friends, or sell your idea to a chicken farmer. But the major goal is to build a successful package.

Your goals must take into account the specifications of the problem. These tell you about the conditions the solution must meet. The specifications, or design criteria for the egg package include:

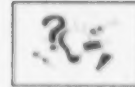
- The package may only be made from the materials provided by your instructor.
- No part of the package may be attached directly to the egg.
- The egg must be dropped onto a hard surface from a distance of three feet.

If one of the specifications is not met, the solution may not be acceptable.

2. SET GOALS AND CONSIDER THE SPECIFICATIONS

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES



There are many different ways to develop alternative solutions to the problem. Some already discussed are **trial and error** or **past experience**. Another method, used in a group, is **brainstorming**. This is a very informal process where group members propose any idea that pops into their heads, no matter how silly or impractical it may seem. Often, one person's "silly" idea will be the key to the solution. Some problems are solved by **insight** when an idea simply "pops" into your head. Others are solved by **accident**, sometimes when a person is trying to solve an entirely different problem. However, you cannot count on these two methods and wait for the solution to just appear from nowhere.

After you have selected alternate solutions, it is time to narrow them down to the best solution. Each solution must be considered in terms of the problem definition and the criteria. Will it solve the problem, and will it solve it within the limitations? Once you have eliminated those that do not fit these requirements, you can begin researching and testing the other alternatives. This is an important step. Useless or even harmful products can make their way into the marketplace without adequate research and testing at this point.

When you have determined the best solution, you can implement it. Many people consider the problem solved at this point. But this is not always the case.

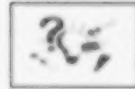
3. DEVELOP ALTERNATIVES

4. SELECT THE BEST SOLUTION

5. IMPLEMENT THE SOLUTION

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 1 ACTIVITIES

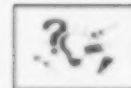


Once you have tried your solution you must evaluate it. Observe the results of your solution for **feedback**. For example, you may open your egg package and find an unbroken egg. This is feedback that tells you your solution worked. If the egg is broken, it is also feedback. In this case, your solution did not work. Evaluation may be a one-time check on an egg or it may be a continuous process.

6. EVALUATE THE RESULTS

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



On Day 2 you should complete the following activities:

- ① Write an essay about a problem you have solved in the past.
- ② Cut an 8 1/2" X 11" piece of paper in a way that allows you to stretch it over the longest possible distance.

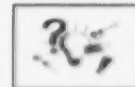
SUMMARY OF ACTIVITIES



- ◆ Define a problem
- ◆ Predict results/outcomes
- ◆ Identify/develop alternatives
- ◆ Evaluate alternatives
- ◆ Select an alternative

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



Write a one-page essay, using correct grammar and spelling, on a problem you have solved in the past.

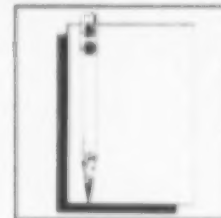
In this activity you will write about a problem you have solved and how you solved it.

- Paper
- Pen or pencil

OBJECTIVE 1

INTRODUCTION

TOOLS AND MATERIALS



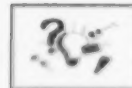
FOLLOW THESE STEPS:

- STEP 1:** Using correct grammar and spelling, write a one-page essay on a problem you have solved in the past and how you solved it. Did you use any of the steps in the Problem Solving System? If so, discuss them. Did your solution work the first time, or did you have to modify it?

PROCEDURE

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



FOLLOW THESE STEPS:

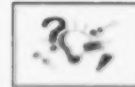
STEP 2: When you finish, clean work area and return tools and materials to their proper storage areas.

IMPORTANT: Continue Day 2 Activities by completing Objective 2.



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



Cut an 8 1/2" X 11" piece of paper in such a way that it can be stretched over the longest distance possible without breaking and measure the distance it is stretched.

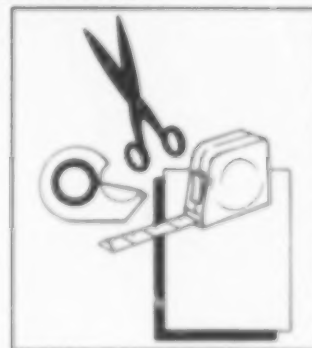
In this activity you will take an ordinary piece of paper and cut it in a way that allows you to stretch it out over the longest possible distance. Because you cannot let the paper break, you will have to compromise between length and strength. You may only use the tape to hold one end of the paper down while you stretch out the other end — you cannot tape pieces of paper together.

- One sheet 8 1/2" X 11" paper
- Scissors
- Tape
- Yardstick (or tape measure)

OBJECTIVE 2

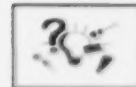
INTRODUCTION

TOOLS AND MATERIALS



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



FOLLOW THESE STEPS:

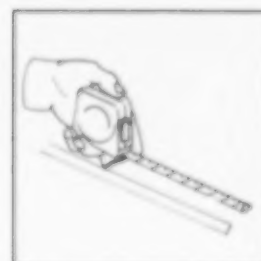
STEP 1: Cut the paper so that it can be stretched into a continuous strip.

STEP 2: Put the yardstick on the floor or a work surface. Tape one end of the paper strip at the zero end of the yardstick.

STEP 3: Carefully stretch the other end of the strip as far as you can along the yardstick without breaking it and note the measurement. If the paper breaks or tears, measure at the broken point.

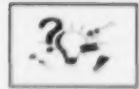
STEP 4: Return the paper to its normal shape and write your name and how far you stretched it on the paper. Turn this in to your instructor.

PROCEDURE



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 2 ACTIVITIES



FOLLOW THESE STEPS:

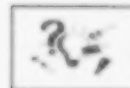
- STEP 5:** When you finish, clean work area and return tools and materials to their proper storage area.



If you complete Day 2 Activities with time left over, you may begin Day 3 Activities.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 3 ACTIVITIES



On Day 3 you should complete the following activities:

- 1 Design two Egg Drop Packages that will protect an egg from cracking when dropped from a height of three feet.

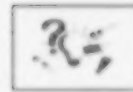
SUMMARY OF ACTIVITIES



- ♦ Define a problem
- ♦ Predict results/outcomes
- ♦ Identify/develop alternatives
- ♦ Evaluate alternatives
- ♦ Select an alternative

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 3 ACTIVITIES



Design at least two packages and build one, using only the materials provided, that will protect an egg from cracking when dropped from a height of three feet.

In this activity you will use the Problem Solving System to design at least two alternative packages to protect an egg and select the best alternative.

The specifications for your package are:

- The package must hold one egg and protect it from cracking when dropped onto a hard surface from a distance of three feet.
- The package may be made only from materials provided by your instructor.
- No part of the package may be directly attached to the egg, it must sit freely inside the package.

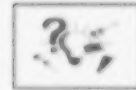
OBJECTIVE 3

INTRODUCTION



TECHNOLOGY EDUCATION PROBLEM SOLVING

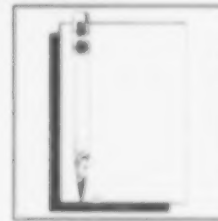
DAY 3 ACTIVITIES



➤ 3 sheets paper

➤ Pencil

TOOLS AND MATERIALS



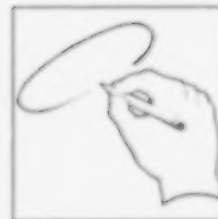
FOLLOW THESE STEPS:

STEP 1: On one sheet of paper, write your name and define your problem.

STEP 2: Using the other two sheets of paper as scratch paper if needed, draw two rough designs for a package to protect an egg. Draw the final designs on the first sheet of paper, using the back if needed.

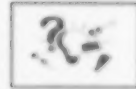
STEP 3: Select the best design and make a note on the paper that this is the design you will build.

PROCEDURE



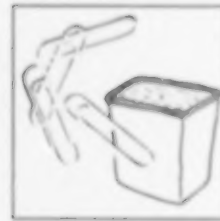
TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 3 ACTIVITIES



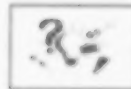
STEP 4: When you finish, clean work area and return tools and materials to their proper storage areas.

If you complete Day 3 Activities with time left over, you may begin Day 4 Activities.



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 4 ACTIVITIES



On Day 4 you should complete the following activities:

- ① Build the Egg Drop Package you designed on Day 3.
- ② Test the package.

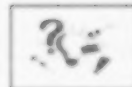
SUMMARY OF ACTIVITIES



- ◆ Create a finished product
- ◆ Evaluate results/outcomes

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 4 ACTIVITIES



Design at least two and build one package, using only the materials given, that will protect an egg from cracking when dropped from a height of three feet.

In this activity you will build and test the package you designed to hold an egg. You should follow your design as closely as possible. Minor changes may be necessary, but do not radically depart from your original design.

- One fresh egg (ask your instructor where you should get this — do not leave the lab without permission.)
- 36" masking tape
- 10 Popsicle sticks
- 3 paper towels
- 15 drinking straws
- Scissors
- Stapler
- Plastic wrap
- Yardstick or tape measure

OBJECTIVE 4

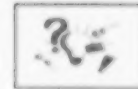
INTRODUCTION

TOOLS AND MATERIALS



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 4 ACTIVITIES



FOLLOW THESE STEPS:

STEP 1: Using only the materials listed above, construct your design. Remember, the package can **not be attached directly to the egg**. You may build the package around the egg or add the egg when you are finished.

STEP 2: Attach the plastic wrap with tape to the floor (if you do not have any tape left over, get some from your instructor.)

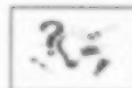
STEP 3: Use the yardstick or tape measure to measure three feet from the floor.

PROCEDURE



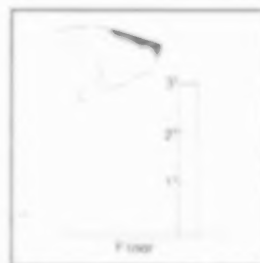
TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 4 ACTIVITIES



FOLLOW THESE STEPS:

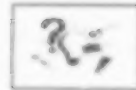
- STEP 4:** Drop (do not throw) the package onto the plastic wrap.
- STEP 5:** Without picking up the package, carefully open it and see if the egg is cracked.
- STEP 6:** If the egg is broken, get your instructor to evaluate your package and then carefully dispose of all materials. If the egg is not broken, remove it and dispose of it.
- STEP 7:** When you finish, clean work area and return tools and materials to their proper storage areas.



If you complete Day 4 Activities with time left over, you may begin Day 5 Activities.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 5 ACTIVITIES



On Day 5 you should complete the following activities:

- 1 Design and build the "Leaning Tower of Tennis Ball."

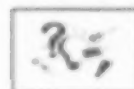
SUMMARY OF ACTIVITIES



- ◆ Define a problem
- ◆ Identify/develop alternatives
- ◆ Evaluate alternatives
- ◆ Select an alternative
- ◆ Create a finished product
- ◆ Evaluate results/outcomes

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 5 ACTIVITIES



Design and build the tallest possible structure, using drinking straws and masking tape, that will support a tennis ball for at least 30 seconds.

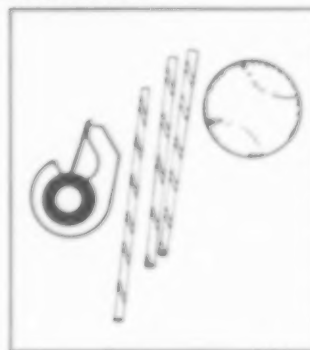
In this activity you will design and build the "Leaning Tower of Tennis Ball." Your tower must be entirely free-standing (it cannot be taped to the floor or table) and made only of the materials supplied to you. It must support a tennis ball placed on it for at least 30 seconds without collapsing or falling over.

- 3 sheets paper
- Pencil
- 30 drinking straws
- 24" masking tape
- Tennis ball
- Yardstick or tape measure

OBJECTIVE 5

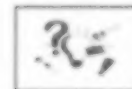
INTRODUCTION

TOOLS AND MATERIALS



TECHNOLOGY EDUCATION PROBLEM SOLVING

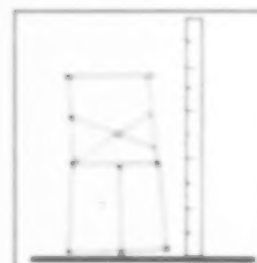
DAY 5 ACTIVITIES



FOLLOW THESE STEPS:

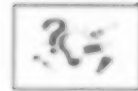
- STEP 1:** On one sheet of paper, write your name and define your problem.
- STEP 2:** Using the other paper for scratch paper if needed, design at least two structures. Draw the final designs on the first sheet of paper, using the back as needed.
- STEP 3:** Select the best structure and note on your paper that this is the one you will build.
- STEP 4:** Build the structure you selected, following your design as much as possible.
- STEP 5:** Use the yardstick or tape measure to measure the height of your tower and mark the height on your paper.

PROCEDURE



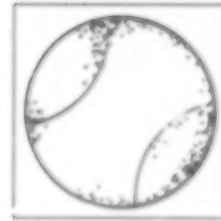
TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 5 ACTIVITIES



FOLLOW THESE STEPS:

STEP 6: Test the structure by placing a tennis ball on top of it and timing for 30 seconds. Write down whether the tower passed the test.



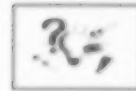
STEP 7: When you finish, clean work area and return tools and materials to their proper storage areas.



If you complete Day 5 Activities with time left over, you may begin Day 6 Activities.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 6 ACTIVITIES



On Day 6 you should complete the following activities:

- ① Design a budget around the income and expenses given to you.
- ② Modify this budget when a new expense is added.

SUMMARY OF ACTIVITIES



Operation and Calculation Skills:

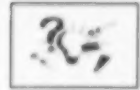
- ◆ Calculate with whole numbers

Functional Math Skills:

- ◆ Prepare a budget
- ◆ Solve income/expense problems

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 6 ACTIVITIES



Given an income and required and optional expenses, design a monthly budget.

For this activity you will be given a monthly income and a list of expenses. Some of the expenses will be required and must be included in your budget. Others are optional.

- 2 sheets paper
- Pencil or pen
- Calculator (optional)

FOLLOW THESE STEPS:

STEP 1: Use one sheet of paper as scratch paper. Write your name on the other sheet. Write down your monthly income: \$1000.

OBJECTIVE 6

INTRODUCTION

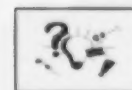
TOOLS AND MATERIALS



PROCEDURE

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 6 ACTIVITIES



FOLLOW THESE STEPS:

STEP 2: Each of the categories below is a **required monthly expense**. Select one alternative for each category.

Housing

Live with parents	-0-
Live with roommate	150.00
Live alone	300.00

Transportation

Bus and bicycle	50.00
Economy car	200.00
Sports car	350.00

Food and Supplies

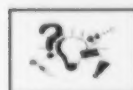
Mostly cooking	100.00
Mostly eating out	200.00

STEP 3: Each of the categories below is an **optional monthly expense**. Select as many as you can afford. You should end up with zero left at the end of each month.

Dates, movies, etc.	100.00
Savings	50.00
Clothes	100.00
Tanning salon	25.00
Gifts	25.00
Magazines & books	25.00
Tools	25.00
Concerts & records	50.00

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 6 ACTIVITIES



FOLLOW THESE STEPS:

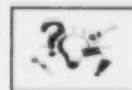
STEP 4: Write your final budget on the first piece of paper and label it "original budget." Label each expense. Your budget might look like this:

1000	Income
-150	Live with roommate
-350	Sports car
-200	Mostly eating out
-100	Dates, movies, etc.
-100	Clothes
- 50	Savings
- 50	Concerts & records
-0-	

IMPORTANT: Continue Day 6 Activities by completing Objective 7.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 6 ACTIVITIES



Adjust your budget to cover a new expense.

In this activity you will acquire a new monthly expense that will force you to revise your budget. You can drop optional expenses and change required expenses (housing, transportation, and food and supplies) but you cannot eliminate any required expenses.

FOLLOW THESE STEPS:

- STEP 1:** After an emergency appendectomy, you are faced with a \$5000 hospital bill. The hospital agrees to let you pay the bill at \$150 per month. Revise your budget to include this new payment.
- STEP 2:** Write the new budget next to the original budget and call it "revised budget."
- STEP 3:** When you finish, clean work area and return tools and materials to their proper storage areas.

If you complete Day 6 Activities with time left over, you may begin Day 7 Activities.

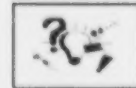
OBJECTIVE 7

INTRODUCTION

PROCEDURE

TECHNOLOGY EDUCATION PROBLEM SOLVING

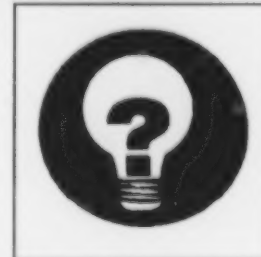
DAY 7 ACTIVITIES



On Day 7 you should complete the following activities:

- 1 Design a device that will let people walk on ice and snow without slipping.

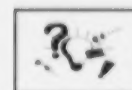
SUMMARY OF ACTIVITIES



- ◆ Define a problem
- ◆ Identify/develop alternatives
- ◆ Evaluate alternatives
- ◆ Select an alternative
- ◆ Create a finished product
- ◆ Evaluate results/outcomes

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 7 ACTIVITIES



Design a device that will allow people to walk on ice and snow, wearing normal shoes, without slipping.

For this activity you will design a device that will help people walk on slippery surfaces. The device must allow them to wear their own shoes. It can attach to their regular shoes, but it does not have to. Use your imagination.

➤ 3 pieces paper

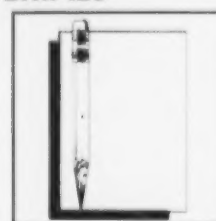
➤ Pencil or pen

OBJECTIVE 8

INTRODUCTION

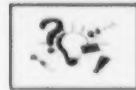


TOOLS AND MATERIALS



TECHNOLOGY EDUCATION PROBLEM SOLVING

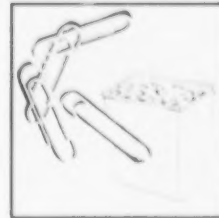
DAY 7 ACTIVITIES



FOLLOW THESE STEPS:

- STEP 1:** Design your device, using scratch paper as needed.
- STEP 2:** Draw a final sketch and explain how the device works and what it is made of. Write your name on this page.
- STEP 3:** When you finish, clean work area and return tools and materials to their proper storage areas.

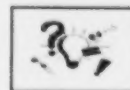
PROCEDURE



If you complete Day 7 Activities with time left over, you may begin Day 8 Activities.

TECHNOLOGY EDUCATION PROBLEM SOLVING

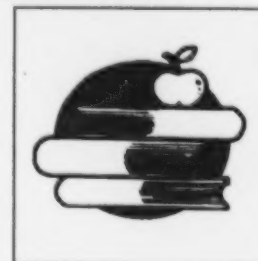
DAY 8 ACTIVITIES



On Day 8 you should complete the following activities:

- ① Complete any unfinished assignments
- ② Read Impact Statements
- ③ Complete Career Search Activity
- ④ Complete the Posttest

SUMMARY OF ACTIVITIES



Reading Comprehension Skills:

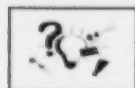
- ♦ Gain factual information
- ♦ Make generalizations

Functional Reading Skills:

- ♦ Follow written instructions
- ♦ Interpret graphics and symbols
- ♦ Use content area vocabulary

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 8 ACTIVITIES



PROBLEM SOLVING IMPACTS

ENVIRONMENTAL IMPACT



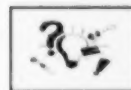
One especially important area where problem solving skills are needed is the environment. Today we are trying to come up with solutions to new and old environmental problems.

For example, the ozone layer that surrounds the earth and protects us from harmful radiation is being damaged by many common products. We tried to solve this problem by using fewer products containing *fluorocarbons*, which are believed to harm the ozone layer.

Another environmental implication is fuel. Fossil fuels, such as oil and gasoline, used to be cheap and plentiful. Now we see higher prices and fuel shortages. Burning these fuels also causes pollution. People are trying to solve these problems by coming up with new fuels that will be cheap, clean, and safe.

TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 8 ACTIVITIES



Problem solving is a daily occurrence for most people, although many probably do not even realize it. Deciding what to wear, where to eat, and what movie to see present problems (however small they may be) that must be solved.

Problem solving often brings people closer together. Have you ever noticed how many people are willing to help look for a contact lens, suggest a good place to get your hair cut, or tell you that you should break up with somebody? Disasters such as tornadoes and hurricanes are also known for bringing people together. People seem to instinctively help others solve their problems. Of course, unsolved problems can also create stress that forces people apart.

Businesses and industries use problem solving techniques to develop new products and modify existing ones. They must try to design the best product for the lowest price.

Individuals also must use problem solving to handle economic situations. Setting up a household budget, for example, is a common solution to the problem of limited income and unlimited wants and needs.

SOCIAL IMPACT

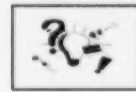


ECONOMIC IMPACT



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 8 ACTIVITIES



Many federal, state, and local laws were created in response to problems that needed to be resolved. For example, the Civil Rights Amendment addressed problems being faced by minorities in the United States. On a more local level, cities may designate certain areas as floodplains to prevent people from building houses or businesses in these areas and later being flooded.

Ergonomics means developing products and systems that are comfortable for people to use and that fit their needs. Problem solving is a very important aspect of this development. In order to design a product ergonomically, you must find out what consumers want and find a reasonable way to provide it. These are problem solving techniques.

POLITICAL IMPACT

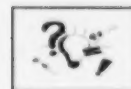


ERGONOMIC IMPACT



TECHNOLOGY EDUCATION PROBLEM SOLVING

DAY 8 ACTIVITIES



CAREER SEARCH

DIRECTIONS

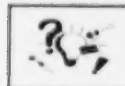
Using *Career Search Abstracts*, find the occupations listed below. Read the information about each. Select the two occupations that sound most appealing to you. On a separate sheet of paper, list the two occupations you selected and tell why. Remember to write using complete sentences, proper grammar, and correct spelling. Give the sheets to your instructor.

- Judge
- Management Analyst
- Computer Systems Analyst
- Detective
- Industrial Designer

RELATED CAREERS

PROBLEM SOLVING CAREER SEARCH ABSTRACTS

DAY 8 ACTIVITIES



JUDGE

Nature of the Occupation

Judges are elected or appointed public officials with authority to hear and decide legal matters. They may also arbitrate disputes and advise attorneys, claimants, defendants, jury members, and court personnel.

Duties may include but are not limited to the following:

- Establishing rules of procedure
- Researching legal matters
- Reading or listening to statements
- Listening to case presentations by lawyers
- Settling disputes
- Instructing jury members on applicable law and proper procedures
- Determining the guilt or innocence of individuals in nonjury cases
- Sentencing defendants in criminal cases according to state and federal laws

Occupation Specialties

(Dot codes in parenthesis)

Juvenile Court Judges

(111 107 010) arbitrate, advise, and administer justice in matters dealing with youth and young adults

Probate Judges (111 107 010)

arbitrate, advise, and administer justice in estate matters and the registration and certification of official documents such as last wills and testaments.

Working Conditions

Judges may work alone or with law clerks. They work in neat, clean, and well-furnished courtrooms and office chambers.

Judges usually work 40 hours a week. This time is spent between



court sessions and research work. Additional research, studying previous rulings, and reviewing case documents may require judges to work longer hours.

Travel may be required for judges presiding over more than one district.

Judges join professional associations such as the American Bar Association. Members pay dues.

Tools, Equipment and Materials used may include:

- Law Books
- Legal Papers
- Dictating Equipment

Worker Requirements

You should like:

- Activities concerned with the communication of data
- Activities involving business contact with people

You should be able to:

- Perform a variety of duties
- Reason clearly and logically
- Make decisions based on personal judgment
- Advise and counsel people
- Understand the meanings and relationship of words and use them effectively
- Perform mathematical operations quickly and accurately

Physically you must:

- Sit for long periods of time
- Talk and hear

Special Requirements:

All states require judges to possess a law degree and pass their respective state bar exams.

Opportunities for Experience:

Visiting local courts will provide useful observation of courtroom procedures and the duties of judges.

OCCUPATION SPECIALTIES

DOT CODE:

111 107-010 Judge

111 107-010 Juvenile Court Judge

111 107-010 Probate Judge

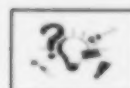
SOC CODE: 212

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OKLAHOMA
CAREER
SEARCH

PROBLEM SOLVING CAREER SEARCH ABSTRACTS

DAY 8 ACTIVITIES



JUDGE

Methods of Entry:

After practicing as a professional lawyer, one may run for election or seek appointment as a judge.

Earnings and Advancement

Earnings depend upon the judicial level and geographic location.

Earnings:

In 1990, federal trial court judges had salaries of \$92,800, while appellate court judges earned \$99,000 a year. Federal judges with limited jurisdiction had salaries of \$85,800, and full-time federal administrative law judges had average salaries of \$73,800 in 1990. Annual salaries of state trial court judges ranged from \$51,300 to \$99,000, while state appellate court judges had salaries ranging from \$61,600 to \$106,900 per year.

Fringe Benefits:

Judges may receive paid vacations and holidays; life, health, and hospitalization insurance; and retirement benefits. Judges may also receive a cost-of-living allowance, travel and library allowances, and payment of state bar or other association dues.

Career Ladder for this Occupation may look like this:

- State or Federal Court Judge
- City or County Judge
- Lawyer

Judges may advance through experience and personal qualifications.

Employment and Outlook

There were approximately 40,000 judges, magistrates, and other judicial workers employed nationally in 1988. Employment is expected to grow about as fast as the average for all occupations as case loads increase.

Judges held about 682 jobs in Oklahoma during 1986. That number is expected to increase to 716 by 1992, which represents a 5.14 percent change. Job openings each year for judges will equal approximately 110, with 104 of those due to replacements and 6 created through new jobs.

Related Education and Training

Level(s) of education and training usually needed for this occupation:

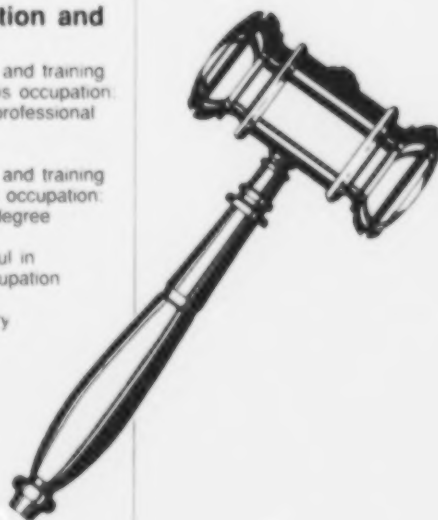
- College Ph.D. or professional degree

Level(s) of education and training also available for this occupation:

- College master's degree

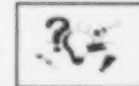
School subjects helpful in preparing for this occupation include:

- College Preparatory
- English
- Algebra
- Government
- Humanities
- Psychology
- Composition
- Speech
- Economics
- History
- Political Science
- Sociology



More Sources of Information

- American Bar Association
750 North Lake Shore Drive
Chicago, IL 60611
- Association of American Law Schools
One Dupont Circle, NW
Suite 370
Washington, DC 20036
- Federal Bar Association
1815 H Street, NW
Washington, DC 20006
- National Council of Juvenile and Family Court Judges
Box 8970
University of Nevada
Reno, NV 89507



MANAGEMENT ANALYST & CONSULTANT



Nature of the Occupation

Management analysts and consultants collect and analyze data, make recommendations, and help implement their proposals.

Duties may include but are not limited to the following:

- Analyzing statistics and other data
- Interviewing employees
- Observing operations
- Developing solutions to problems
- Submitting written recommendations to clients
- Making oral presentations
- Helping implement suggestions

Occupation Specialties

(Dot code in parenthesis)

Records Management

Directors (161.117-014) plan, develop, and administer policies to streamline handling of business records.

Forms Analysis Managers

(161.167-014) direct and coordinate the activities of workers who analyze business forms.

Records Analysis Managers

(161.167-018) direct and coordinate activities of workers

who analyze systems of records management.

Reports Analysis Managers

(161.167-022) direct and coordinate activities of workers who analyze business reports.

Clerical-Methods Analysts

(161.267-010) examine and evaluate clerical work to develop improved methods and procedures.

Reports Analysts

(161.267-026) examine and evaluate business reports to improve format, use, and control.

Working Conditions

Management analysts and consultants divide their time between their own offices and clients' operations, which may be potentially hazardous or dirty. They work at least 40 hours a week, with frequent overtime and travel. Maintaining and expanding clientele can be difficult. Stress may develop from constant deadlines, client expectations, and occasional hostility from client employees.

Tools, Equipment and Materials used may include:

- Computers
- Typewriters
- Calculators
- Business Forms & Reports

Worker Requirements

You should like:

- Working on a problem until a solution is found
- Working with people
- Working with information
- Performing a variety of duties that may change often
- Traveling frequently

You should be able to:

- Express yourself clearly and persuasively
- Evaluate problems with personal judgment
- Make decisions using measurable standards
- Plan and direct activities

Physically you must:

- See well, naturally or with correction
- Speak and hear well
- Sit for long periods

Special Requirements:

Consultants with master's degrees in business or public administration are preferred. Those with bachelor's degrees should also have several years of appropriate work experience as managers.

Opportunities for Experience:

Detailed fields within business, management, computer and information sciences, and engineering provide good background for this occupation. Some employers also seek candidates with experience in education, communications, marketing, distribution, architecture, and environmental design.

Methods of Entry:

This occupation may be entered by direct application to employers. Positions may be found in newspaper.

OCCUPATION SPECIALTIES

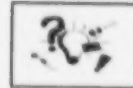
DOT CODE:

161.117-014 Records Management Director
161.167-010 Management Analyst
161.167-014 Forms Analyst Manager
161.167-018 Records Analyst Manager

161.167-022 Reports Analyst Manager
161.267-010 Clerical Methods Analyst
161.267-026 Reports Analyst

SOC CODE 142

**OKLAHOMA
CAREER
SEARCH**



MANAGEMENT ANALYST & CONSULTANT

want ads, professional journals, college placement offices, and state employment offices.

Earnings and Advancement Earnings:

Earnings:

Salaries for management analysts and consultants vary widely by experience, education, and employer. Salaries in 1990 averaged about \$37,929, with a range from \$27,061 to \$155,427 for the middle 50 percent. Self-employed analysts and consultants generally earned much more than the salaried employees in this profession. Management analysts with the Federal Government averaged \$37,028 in 1990.

Fringe Benefits:

Salaried analysts and consultants may receive paid vacations and holidays, life, accident, hospitalization, and disability insurance, retirement plans, and sick leave. For outstanding work, bonuses and profit sharing may be given. Travel expenses are usually reimbursed by employers. The self-employed must handle benefits for themselves.

Career Ladder for this Occupation may look like this:

- Partner/Owner of Firm
- Supervisor of Several Teams
- Team Leader
- Consulting Team Member

Management analysts hired out of school may participate in formal company training programs and later attend conferences to keep up to date in their field.

Employment and Outlook

There were about 130,000 management analysts and consultants in 1988, about half of whom were self-employed. Many worked for governments. The majority of those with the Federal Government were found in the defense department. Employment

is expected to grow faster than the average through the year 2000, as cost reduction measures become increasingly important. The best opportunities will be offered to those with graduate degrees or industry experience. Those who plan to open their own firm should have good marketing and organizational skills.

Management analyst and consultant held about 702 jobs in Oklahoma during 1986. That number is expected to increase to 728 by 1992, which represents a 4.28 percent change. Job openings each year for management analyst and consultant will equal approximately 37, with 33 of those due to replacements and 4 created through new jobs.

Related Education and Training

Level(s) of education and training usually needed for this occupation:

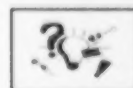
- College bachelor's degree
- College master's degree

School subjects helpful in preparing for this occupation include:

- College Preparatory

More Sources of Information

- Association of Management Consulting Firms
230 Park Avenue
New York, NY 10169
- U.S. Office of Personnel Management
1900 E Street, NW
Washington, DC 20415
- Institute of Management Consultants
230 Park Avenue, Suite 544
New York, NY 10169
- American Management Association
135 West 50th Street
New York, NY 10020-1201
- State or Local Employment Services



COMPUTER SYSTEMS ANALYST

Nature of the Occupation

Computer systems analysts help define the computer process necessary to turn raw data into useful information, plan the distribution and use of results, and test the working systems in operation.

Duties may include but are not limited to the following:

- Consulting with engineering, scientific, or management personnel to define the problem
- Studying the problem and deciding the best way to solve it by using techniques such as cost accounting, sampling, and mathematical model building
- Gathering the information needed to solve the problem
- Preparing flow charts and diagrams
- Recommending the data processing equipment that is to be used and preparing instruction for programmers
- Writing up the results in a non-technical language that managers or customers can understand

Occupation Specialties

(Dot codes in parenthesis)

Electronic Data Processing Systems Analysts (012.167-066) study business procedures and problems to refine data and convert it to a form for electronic data processing.

Working Conditions

Computer systems analysts work closely with programmers, engineers, scientists, technicians, and top-level managers. They also work with clerical and non-supervisory personnel. They sometimes work as part of a team,

but much of their work is done alone. They usually work in offices that are comfortable, well-lighted and air-conditioned. They may also spend time in factories, machine shops, and accounting offices analyzing equipment, procedures, methods, and work loads.

Systems analysts usually work a 5-day, 40-hour week. Evening and weekend work may sometimes be necessary to finish projects.

Out-of-town travel may be necessary for systems analysts who work as consultants.

Systems analysts may join organizations such as the Association for Systems Management, the Data Processing Management Association, or the American Federation of Information Processing Societies. Members may pay periodic fees.

Tools, Equipment and Materials used may include:

- Computer
- Peripheral Equipment
- Flow Charts
- Diagrams

- Reports
- Computer Printouts
- Plotters
- Recorders
- Digital Voltmeters
- Oscilloscopes
- Digital Displays and Readouts
- Reference Books

Worker Requirements

You should like:

- Activities of a scientific and technical nature
- Activities concerned with the communication of ideas

You should be able to:

- Perform a variety of duties which may change often
- Use logical step-by-step procedures to analyze and solve problems
- Rate information by using personal judgment or standards
- Understand the meanings of words and ideas and present information effectively

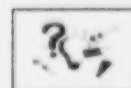


OCCUPATION SPECIALTIES

DOT CODE:

012.167-066 Systems Analyst, Electronic Data Processing

SOC CODE: 1712



COMPUTER SYSTEMS ANALYST

- Perform mathematical operations quickly and accurately
- Look at flat drawings or pictures and imagine how they would look as solid objects

Physically you must

- Maintain good health
- See and hear well, either naturally or with correction

Special Requirements

Many employers prefer people who have had some experience in computer programming.

Opportunities for Experience

Summer or part-time work in computer centers will give you an idea of what the job may be like. Opportunities for experience and exploration are available in all branches of the military.

Methods of Entry

Apply directly to employers and take civil service examinations. College placement offices are of great help in getting a job. Positions may also be located by consulting newspaper want ads.

Earnings and Advancement

Earnings of systems analysts vary according to the employer, the geographic location and the analyst's experience and education.

Earnings

Nationally in 1988, computer systems analysts who are familiar with systems analysis procedures and work independently on routine problems averaged \$38,908 per year. The middle 50 percent earned between \$29,452 and \$49,341 a year. The lowest 10 percent earned less than \$21,627, and the highest 10 percent earned over \$56,000.

Computer systems analysts with a recent bachelor's degree employed by the Federal Government averaged a starting salary of about \$16,400. Fringe Benefits

Most systems analysts receive paid vacations and holidays; life, accident, disability and hospitalization insurance; retirement plans, and sick pay. These benefits are usually paid for, at least in part, by the employer.

Career Ladder for this Occupation may look like this:

- Supervisor
- Systems Analyst
- Junior Systems Analyst
- Trainee

Employment and Outlook

There were approximately 403,000 systems analysts employed nationally in 1988. Employment of systems analysts is expected to grow much faster than the average through the year 2000 as computer capabilities are increased and computers are used to solve a greater variety of problems. College graduates with courses in programming and systems analysis and training and experience in applied fields will have the best job prospects. Persons without a college degree and college graduates unfamiliar with data processing will face competition from the large number of experienced workers seeking jobs as systems analysts.

Computer systems analysts held about 3,506 jobs in Oklahoma during 1986. That number is expected to increase to 4,120 by 1992 which represents a 17.54 percent change. Job openings each year for computer systems analysts will equal approximately 144, with 42 of those due to replacements and 102 created through new jobs.

Related Education and Training

Level(s) of education and training usually needed for this occupation:

- Technical junior or community college
- College bachelor's degree

Level(s) of education and training also available for this occupation:

- On-the-job training
- College master's degree

School subjects helpful in preparing for this occupation include:

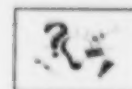
- College Preparatory
- Algebra
- Computer Science
- Statistics
- Accounting
- English
- Calculus
- Geometry
- Trigonometry
- Bookkeeping

More Sources of Information

- Association for Systems Management
24587 Bagley Road
Cleveland, OH 44138
- Data Processing Management Association
505 Busse Highway
Park Ridge, IL 60068
- Local, State, and Federal Civil Service Offices
- School Placement Offices
- Military Recruiters

PROBLEM SOLVING CAREER SEARCH ABSTRACTS

DAY 8 ACTIVITIES



POLICE, DETECTIVE, & SPECIAL AGENT

Nature of the Occupation

Police officers, detectives, and special agents protect life and property, preserve the peace, detect and prevent crime, and maintain public order through the application of the law.

Duties may include but are not limited to the following:

- Patrolling an assigned area or beat
- Preventing crime and making arrests
- Investigating accidents and administering first aid to victims
- Controlling traffic and issuing tickets
- Writing and filing daily activity reports
- Investigating crimes and questioning witnesses
- Examining the scene of a crime for clues and evidence
- Preparing assigned cases for court
- Testifying before a court or grand jury
- Investigating known or suspected criminals to detect planned criminal activity

Occupation Specialties

(Dot codes in parenthesis)

Vice Investigators (375.267-022) investigate people and establishments suspected of breaking anti-vice laws, and conduct raids on such places.

State Highway Police Officers (375.263-018) patrol highways, enforce laws, provide services to stranded motorists, and control traffic during road repairs and emergencies.

Working Conditions

Police officers, detectives, and special agents work in highly

structured organizations. Each officer is supervised by a person of higher rank. Police officers and detectives may work alone, in pairs, or in groups.

Officers may have to work for long periods of time in all kinds of weather. Because they are concerned with people who commit crimes, the risk of injury is higher than in many occupations.

Police officers usually work an 8-hour day, 40-hour week with rotating shifts. However, the work week may vary from 40 to 60 hours. Police officers are subject to call at any time and may work overtime in emergencies.

Police departments usually provide officers with special allowances for uniforms and furnish revolvers, night sticks, handcuffs, and other equipment.

Police officers may belong to unions or associations. Those

who belong pay dues at regular intervals.

Tools, Equipment and Materials used may include:

- Patrol Cars
- Firearms
- Handcuffs
- Call Boxes
- Radios
- Radar
- Surveillance Equipment
- Rescue Equipment
- Emergency First Aid Equipment
- Tear Gas Bombs
- Night Sticks
- Ticket Books

Worker Requirements

You should like:

- Having business contact with people
- Communicating ideas



OCCUPATION SPECIALTIES

DOT CODE

375.263-014 Police Officer

375.267-010 Detective

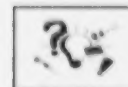
375.267-022 Investigator, Vice

375.263-018 State Highway Police Officer

SOC CODE 5132

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OKLAHOMA
CAREER
SEARCH



POLICE, DETECTIVE, & SPECIAL AGENT

You should be able to:

- Work under stress
- Show good judgment, think logically
- Make very quick decisions

Physically you must:

- Maintain good health
- Hear and see well, either naturally or with correction
- Have average or better strength

Special Requirements:

All officers must be between the ages of 18 and 35 at the beginning of their career, pass written, psychological, and physical examinations, meet minimum height and weight requirements (waived in some areas), and undergo character and background investigations. In nearly all cities, local and civil service regulations govern the appointment of police officers.

Opportunities for Experience:

Part-time work is available in many local police departments. All branches of the military also offer training. Persons between the ages of 18 and 21 may gain experience by becoming police cadets.

Methods of Entry:

Make applications with local civil service offices or check local newspaper ads.

Earnings and Advancement

Earnings for police officers and detectives vary widely according to years of service, rank, location, and size of the community in which they are employed.

Earnings:

Nationally, in 1990, police and detectives employed in public service earned an average starting salary of \$430 per week or \$22,368 per year. These salaries could reach a maximum of \$29,018 per year after about 6 years of service.

In 1990, starting FBI agents earned about \$27,418 a year.

Starting U.S. Treasury Department agents earned between \$16,367 and \$20,328 per year. Salaries of experienced FBI agents started at around \$42,847, while supervisory agents started at around \$50,666 a year. Salaries of experienced U.S. Treasury Department agents started at \$36,070 per year. U.S. Treasury Department supervisory agents started at \$42,847 per year.

Fringe Benefits:

Most cities offer group life and medical insurance, as well as paid sick leave, paid vacations, and retirements plans.

Career Ladder for this Occupation may look like this:

- Captain/Chief
- Lieutenant
- Sergeant
- Police Officer
- Trainee

Police officers may advance after acquiring experience and additional training, demonstrating ability, and passing a promotional examination.

Employment and Outlook

Nationally, in 1988, there were approximately 515,000 police officers, detectives, and special agents employed. Employment is expected to rise at the average rate as slow growth in local government spending limits employment growth. Competition is expected to be keen for job openings through the year 2000. The outlook should be best for persons having some college training in law enforcement.

Related Education and Training

Level(s) of education and training usually needed for this occupation:

- High school diploma or G.E.D.
- Technical junior or community college

Level(s) of education and training also available for this occupation:

- On-the-job training
- College bachelor's degree

School subjects helpful in preparing for this occupation include:

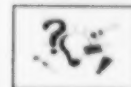
- College Preparatory
- Speech
- Physical Education
- History
- Social Studies
- Drivers' Training
- English
- First Aid
- Government
- Psychology
- Sociology

More Sources of Information

- National Police Officers Association of America
1316 Gardiner Lane
Suite 204
Louisville, KY 40213
- American Federation of Police
1000 Connecticut Ave., NW
Suite 9
Washington, DC 20036
- Federal, State, or Local Civil Service Commissions
- Local Police Departments

PROBLEM SOLVING CAREER SEARCH ABSTRACTS

DAY 8 ACTIVITIES



INDUSTRIAL DESIGNER

Nature of the Occupation

Industrial designers improve the outward form and functional design of manufactured products as well as plan their packaging and trademarks so that products may compete favorably with similar goods on the market. They combine artistic talent with research on product use, marketing, materials, and production methods to create the best and most appealing designs to enhance product marketability and competitiveness.

Duties may include but are not limited to the following:

- Studying the potential need for new products
- Studying other similar products on the market
- Consulting with sales and marketing personnel to obtain design ideas and to estimate public reaction to new designs
- Sketching the design of products, such as automobiles, furniture, household appliances, pens, and toys
- Making comprehensive drawings of the product

Occupation Specialties

(Dot codes in parenthesis)

Industrial designers may specialize in one product or in a variety of products such as automobiles, furniture, household appliances, recreational goods, building compounds, and equipment for offices, hospitals, and other work places. Some industrial designers may also design stores, offices, exhibitions, packaging, and trademarks.

Working Conditions

When designing and developing

products, industrial designers work with engineers, research and marketing personnel, top-level managers, and production experts.

Industrial designers spend much of their time at drawing tables in manufacturing plants or private offices. Work areas are generally clean, well-lighted, and air conditioned. Industrial designers may also spend time in the factory, overseeing the production of their design.



Most industrial designers work a 40-hour week. Those who do consulting work or are self-employed may work long hours when facing deadlines or receiving flat fees for assignments.

Industrial designers who are self-employed must provide their own drafting equipment and other supplies.

Industrial designers may join professional organizations such as the Industrial Designers Society of America. Members pay dues.

Tools, Equipment and Materials used may include:

- Specifications
- Drawing Tables
- Drafting Instruments
- T-Squares
- Straight Edges
- Airbrushes
- Watercolors
- Plastic, Clay, Wood & Wax
- Charts
- Drawing Curves
- Hand Tools
- Triangles
- Templates
- Pencils, Pens & Ink
- Pastes & Glue
- Cameras
- Calculators

Worker Requirements

You should like:

- Activities concerned with data
- Performing work which requires creativity
- Drawing and sketching

You should be able to:

- Reason logically
- Perform mathematical operations quickly and accurately
- Communicate with people and present ideas clearly
- Understand the meanings and relationships of words
- Make decisions based on personal judgment
- Compare and see differences in the size, shape, and form of lines, figures, and objects

OCCUPATION SPECIALTIES

DOT CODE

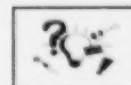
142-061-026 Industrial Designer

SOC CODE: 322

OKLAHOMA
CAREER
SEARCH

PROBLEM SOLVING CAREER SEARCH ABSTRACTS

DAY 8 ACTIVITIES



INDUSTRIAL DESIGNER

- Have agreeable working relationships with others

Physically you must:

- Work easily and skillfully with your hands
- See well, including color vision, either naturally or with correction
- Talk and hear

Special Requirements

Completing a course of study in industrial design at an art school, at the design or art department of a university, or at a technical college is usually required.

Methods of Entry

The most common method of entry is applying directly to employers. When applying, industrial designers are expected to provide a portfolio of their work, which includes drawings, slides, and other materials as evidence of their competence in the field.

Earnings and Advancement

Salaries of industrial designers vary according to the person's education and experience, the size and type of employer, and the geographic area. Industrial designers who have their own consulting firms may have fluctuating incomes, depending on their business for the year. Some industrial designers may work for retainers, that is, they may receive flat fees for given periods of time. During any given period, industrial designers can work for retainers for many different companies.

Earnings

Nationally, in 1990, designers had median salaries averaging \$552 per week or \$28,700 per year. The middle 50% earned between \$18,000 and \$38,000 a year, while the bottom 10% earned less than \$12,300 and the top 10% earned more than \$51,000 per year.

Fringe Benefits

Depending on the employer, most industrial designers receive

paid vacations and holidays, life, accident, disability, and hospitalization insurance, retirement plans, and sick pay. These benefits are usually paid for, at least in part, by the employer.

Career Ladder for this Occupation may look like this:

- Design Manager or Private Consultant
- Design Project Leader
- Industrial Designer
- Industrial Design Assistant

Employment and Outlook

In 1988, there were approximately 62,000 industrial designers employed nationally by consulting firms or large manufacturing companies.

Employment of industrial designers is expected to increase more quickly than the average for all occupations through the year 2000. Emphasis on high technology products and quality, ecology, product safety, and new products in business should increase demand.

Industrial designers held about 1,907 jobs in Oklahoma during 1986. That number is expected to increase to 2,023 by 1992, which represents a 6.29 percent change. Job openings each year for industrial designers will equal approximately 84, with 65 of those due to replacements and 19 created through new jobs.

Related Education and Training

Level(s) of education and training usually needed for this occupation:

- College bachelor's degree
- College master's degree

School subjects helpful in preparing for this occupation include:

- College Preparatory
- Algebra
- Geometry
- Trigonometry
- Drafting
- Mechanical Drawing

- Art
- Blueprint Reading
- Industrial Arts

More Sources of Information

- Industrial Designers Society of America
1142 E Walker Road
Great Falls, VA 22066
- University and College Designers Association
2811 Mishawaka Avenue
South Bend, IN 46615

TECHNOLOGY EDUCATION PROBLEM SOLVING

You will need a computer scan sheet or card to record your answers to the following Posttest. Be sure to write your name, the title of the TLA, the date, and the class period on the computer scan sheet or card using a #2 pencil. Use rows 11-20 to record the answers to the Posttest. If your answers will be hand-scored, use a blank sheet of notebook paper to record your answers and number your answers 11-20.

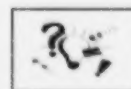
Use rows 21 - 25 on the test card. If the word is spelled correctly, mark (a) on the computer score sheet or card. If the word is spelled incorrectly, mark (b) on the test card. Be sure to use a #2 pencil and make your marks dark. If your answers will be hand-scored, use a blank sheet of notebook paper to record your answers and number your answers 21-25.

(a) correct (b) incorrect

Get Posttest Questions from your instructor.

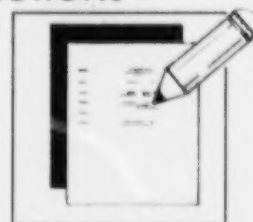
If you complete Day 8 Activities with time left over, you may complete a Skunk Works Activity.

DAY 8 ACTIVITIES



POSTTEST

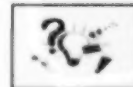
DIRECTIONS



SPELLING TEST INSTRUCTIONS

TECHNOLOGY EDUCATION PROBLEM SOLVING

SKUNK WORKS



The term *Skunk Works* comes from an engineering division of the 3M Company. In the late 1960s a group of engineers at 3M wanted to design a new product but the managers of the company would not give them the money for research. So they decided to design the product anyway, then try to convince the company to market it. Whenever the engineers could grab a few extra minutes from their assignments, they worked on the new product. In early 1969 they presented it to the marketing division of 3M, and the company has been selling it ever since. The product: Velcro fasteners.

Your challenge in this Skunk Works activity is to arrange four bricks in four different ways. Use your creativity and imagination, and remember that an idea that seems silly just may put you on the right track. Some of these have many different solutions. If you get stumped, answers are on the next page.

➤ 4 bricks or wooden blocks

FOLLOW THESE STEPS:

STEP 1: Arrange the bricks so that each brick touches two other bricks.

BACKGROUND

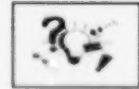
SKUNK WORKS CHALLENGE

TOOLS AND MATERIALS

PROCEDURE

TECHNOLOGY EDUCATION PROBLEM SOLVING

SKUNK
WORKS

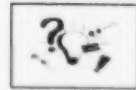


FOLLOW THESE STEPS:

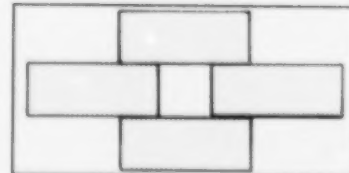
- STEP 2:** Arrange the bricks so that:
 One brick touches only
 one other brick
 and
 One brick touches two
 other bricks
 and
 One brick touches three
 other bricks
- STEP 3:** Arrange the bricks so that
 each brick touches three
 other bricks.
- STEP 4:** Arrange the bricks so that
 each brick touches only one
 other brick.
- STEP 5:** When you finish, clean work
 area and return tools and
 materials to their proper
 storage areas.

TECHNOLOGY EDUCATION PROBLEM SOLVING

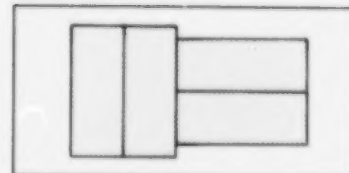
SKUNK WORKS



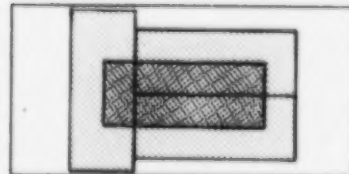
Step 1 solution:



Step 2 solution:



Step 3 solution:



Step 4 solution:



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